Introduction to SHF and the Revolutionary Icom IC-905

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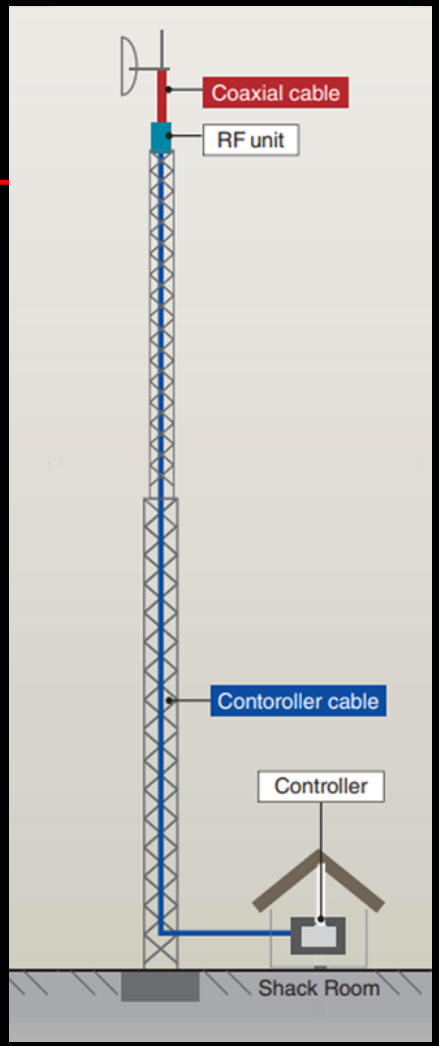
Icom IC-905 Basics

- 144, 430/440, 1200, 2400, 5600 MHz Bands
- 10 GHz Option Available and 24 GHz Coming Soon
- CW, SSB, AM, FM, RTTY, D-STAR DV/DD and FM-TV (Amateur TV)
- Control Head with PoE Power Supply, Connectivity and Heat Sinks
- Mast Mounted Transceiver Powered by PoE
- GPS-Controlled Oscillator for Ultimate Frequency Stability
- Wideband 50 MHz Span Real-time Spectrum Scope
- SD slot, USB-C, Ethernet LAN and More…

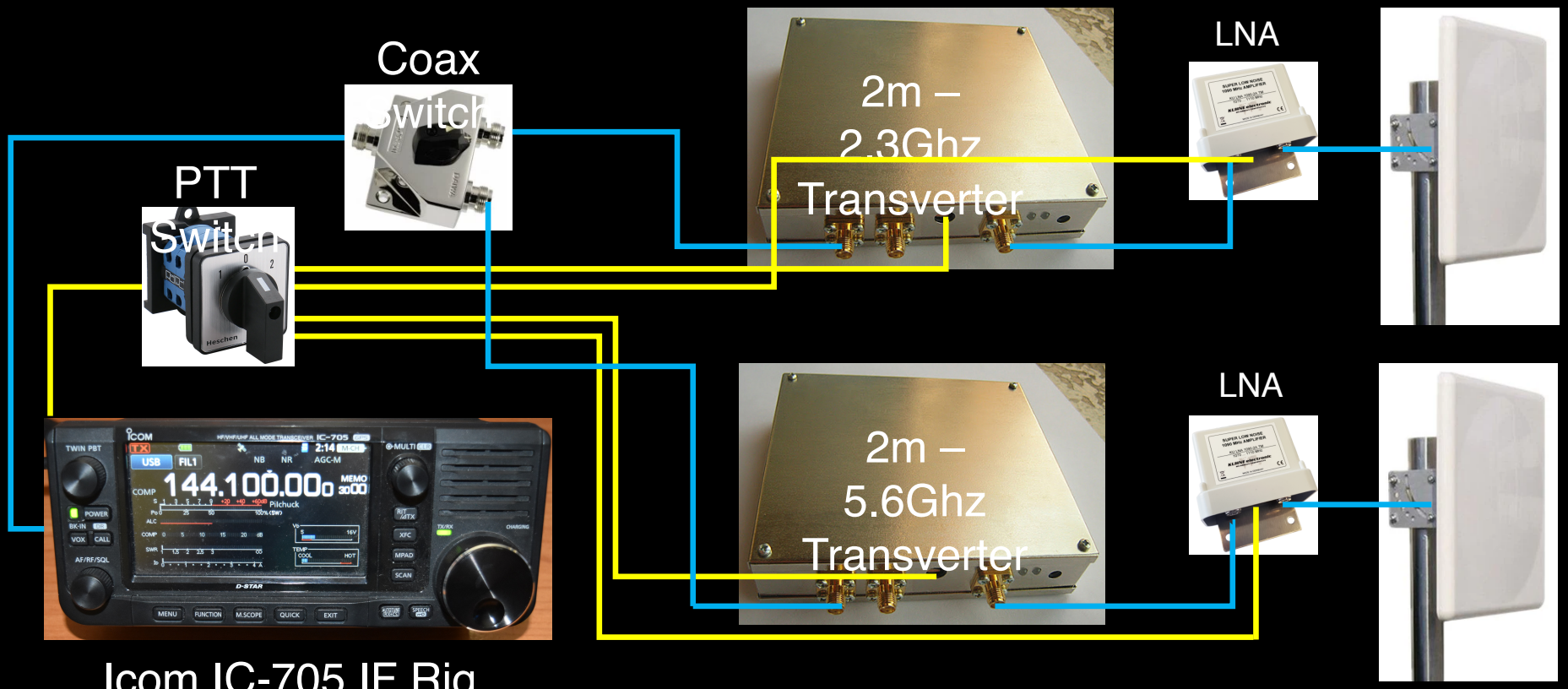
IC-905 Installation Diagram



Why SHF (VHF+)?

- Every license class can participate on VHF+
- Weak signal VHF+ is a different challenge than HF operating
- VHF+ operating is more cooperative
- Antennas are compact and can be quite portable
- All bands have enhancement solutions
  - Not limited to line of sight
- Use the spectrum or lose it
  - 1.2GHz and 3.4Ghz are already at risk
- Plenty of spectrum for all modes, including FM and ATV

The Traditional Microwave Solution



Icom IC-705 IF Rig

Traditional Microwave Issues - Complicated

- Many components with complicated wiring
- Manually switched solutions are simpler/cheaper but error-prone
  - Accidental damage is common when forgetting a switch or connection
- Various transverter and LNA designs create confusion
- Microwave coaxial relays and sequencers are not common
- Many components are only available as boards or kits, no cases
- Not all components are inherently waterproof
- Assembly requires skills, tools, test equipment and time

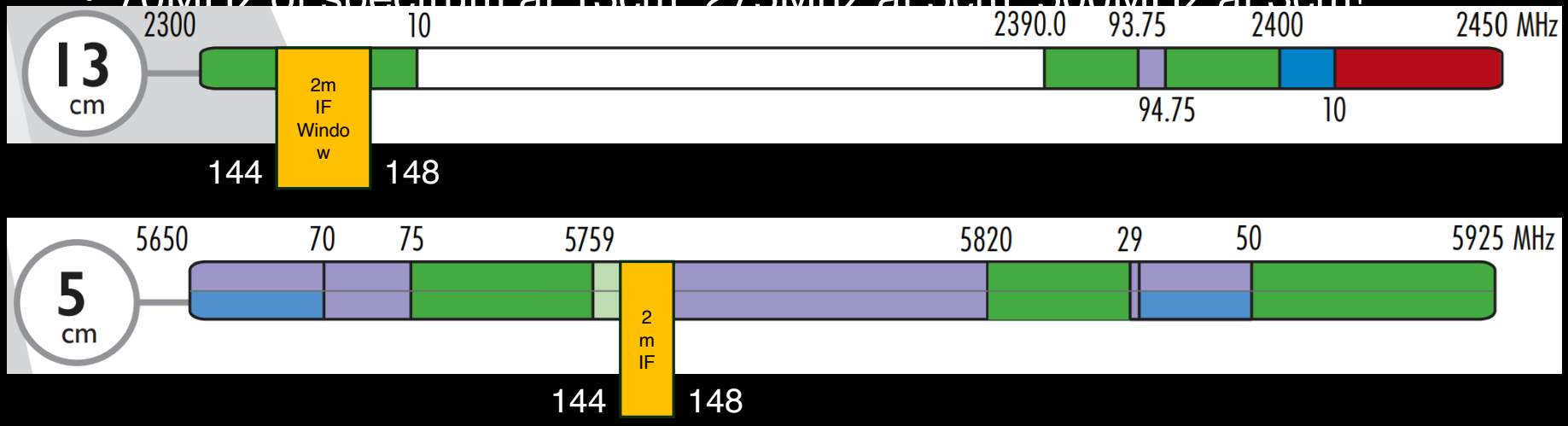
Traditional Microwave Issues - Cost

- Each band can be quite expensive to implement
  - Microwave test gear not represented
  - Note the typically low power of transverter
  - Amplifier pricing not shown
  - Average $1500 per band plus IF Rig
  - $4400 for IC-705 with two transverters

Component	Low Price	High Price
Transverter	$299 w/50mW	$889 w/250mW
LNA	$120	$489
Coaxial Relay	$70	$145
Band Decoder	$45	$299
Sequencer	$37	$248
50’ Feedline	$166–LMR600	$270-LDF4

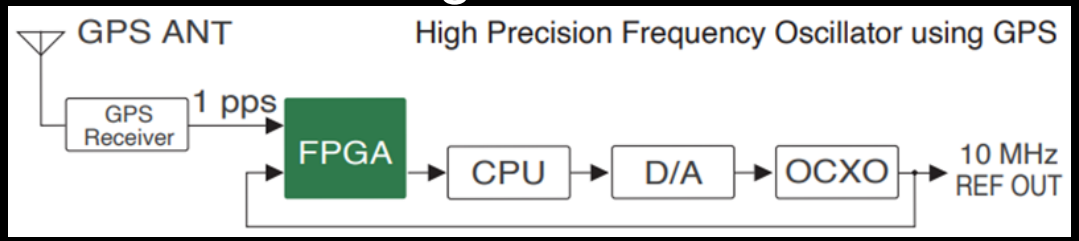
Traditional Microwave Issues - Limiting

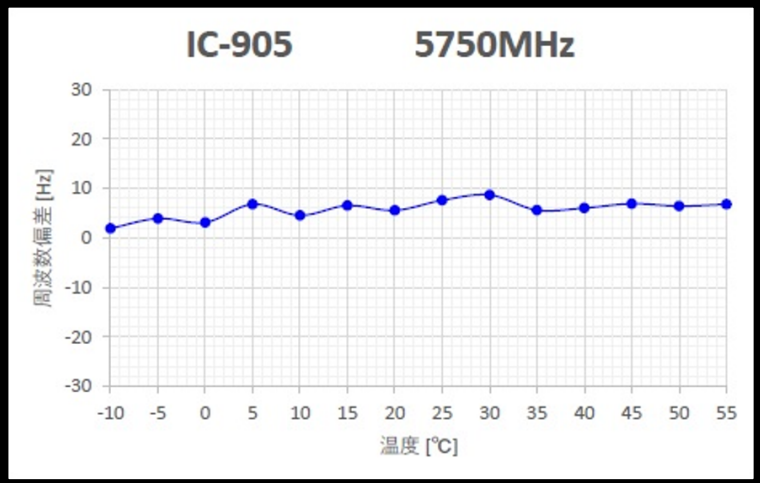
- IF bandwidth limits available spectrum
  - 10m IF provides 1.7MHz, 2m IF provides 4MHz, 70cm IF yields 20-30 MHz
  - 70MHz of spectrum at 13cm, 275Mhz at 5cm, 500MHz at 3cm!



Traditional Microwave Issues - Stability

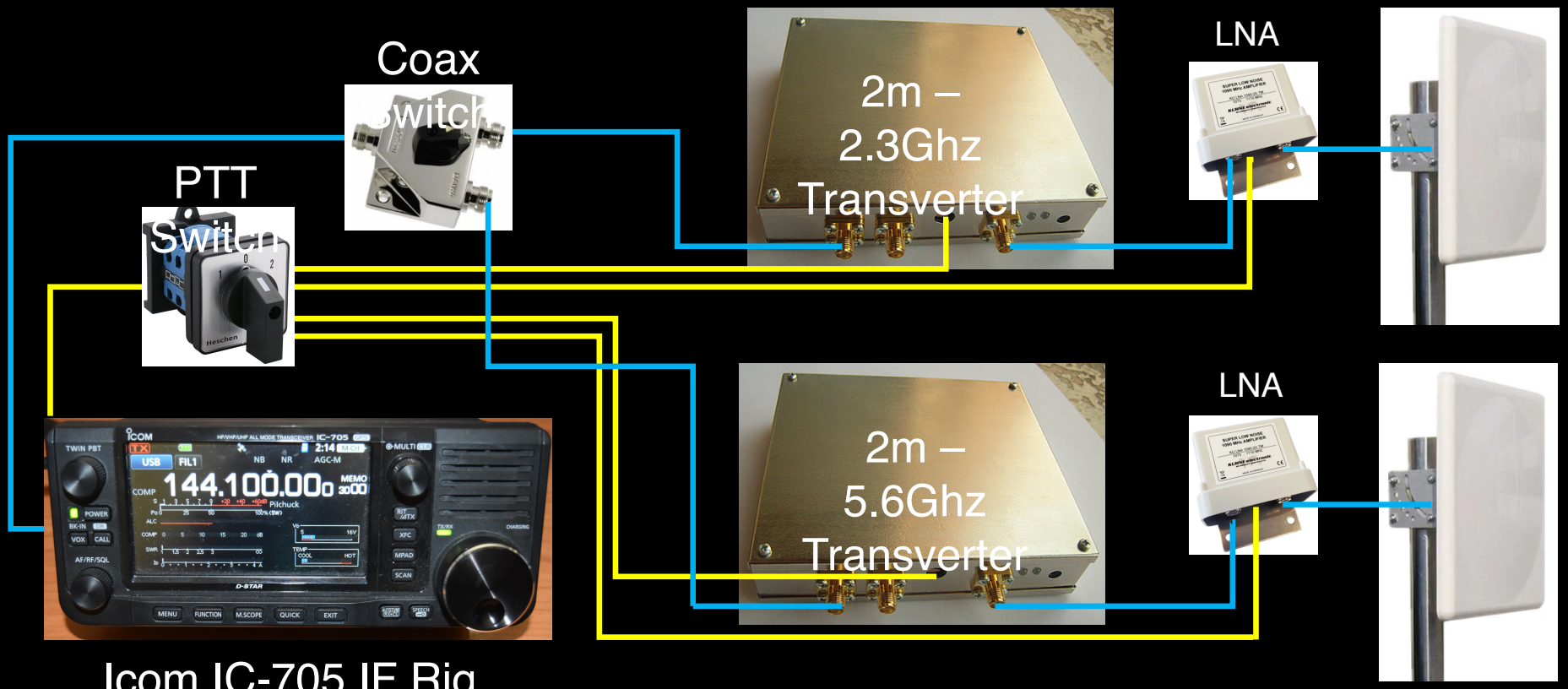
- Transverter oscillators are often inaccurate/unstable (drift)
- Small oscillator errors are significant at microwave frequencies
  - Errors in the kilohertz are common
  - The spectrum scope is helpful finding these signals
- IC-905 uses a high stability OCXO + GPS GNSS signals as a reference



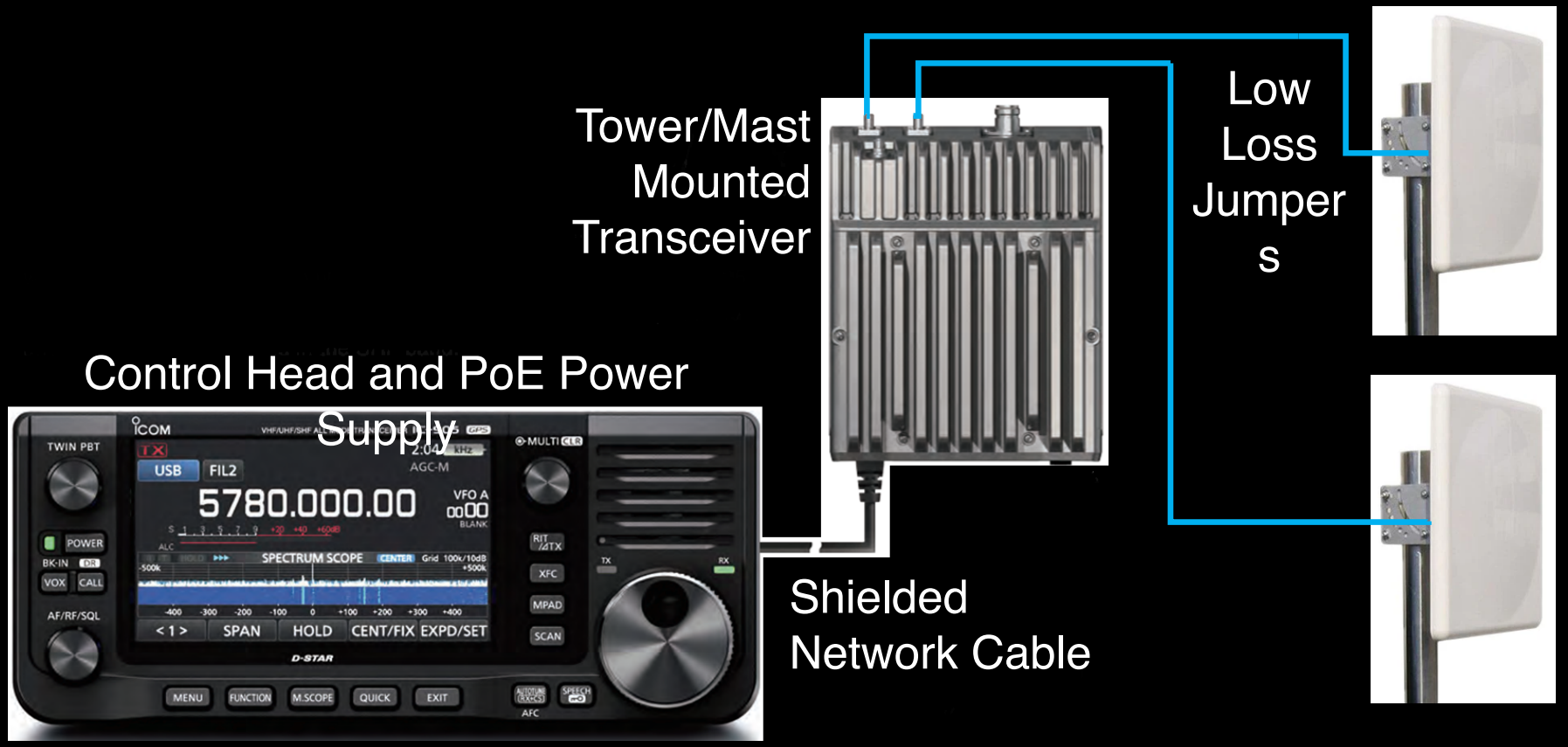


IC-905（OCXO）

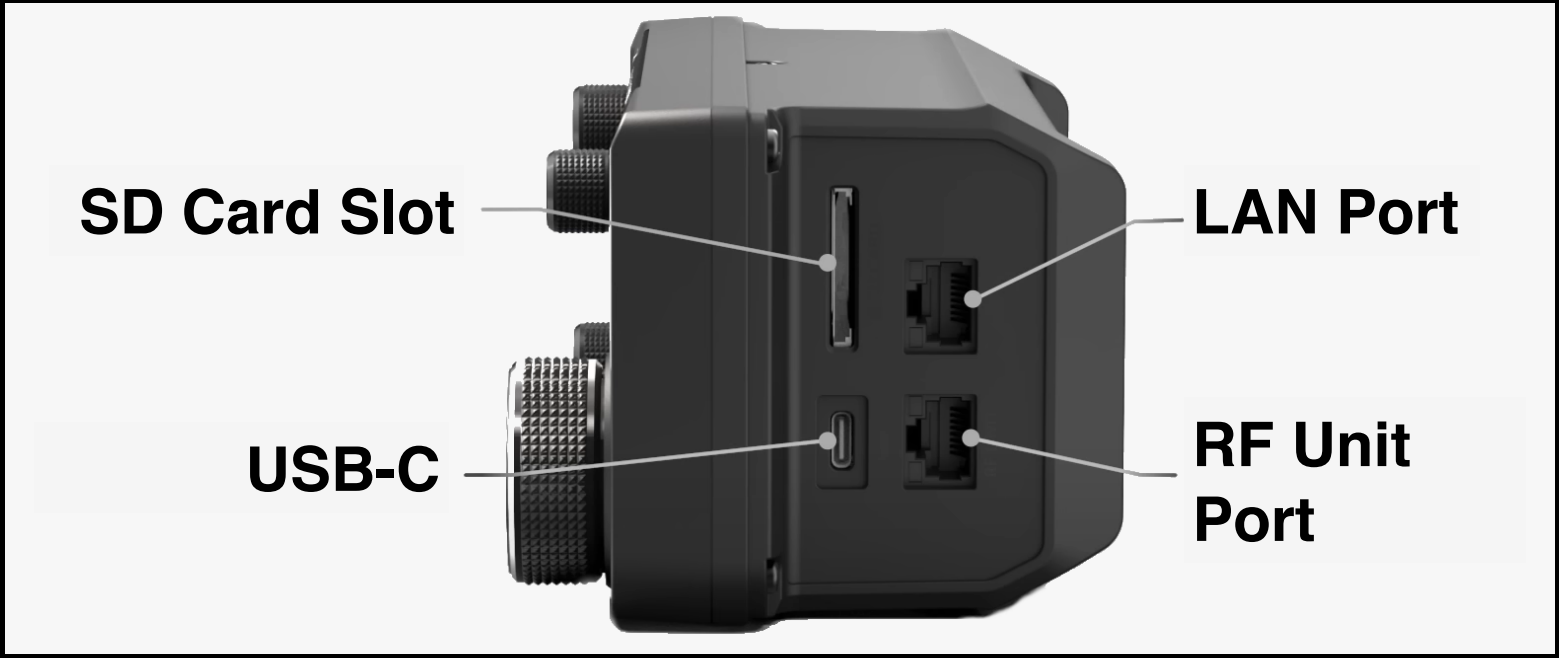
The Traditional Microwave Solution



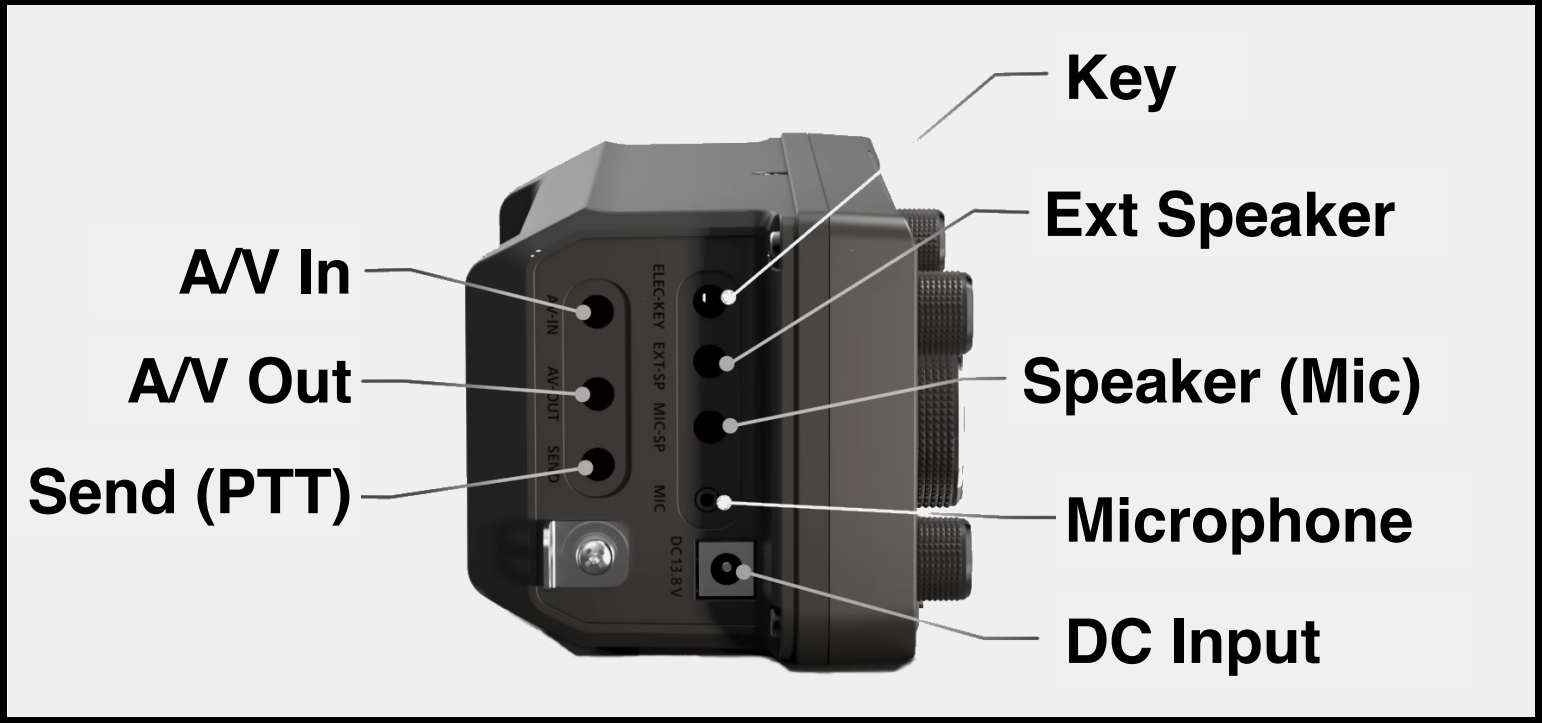
Icom IC-905, A Better Way



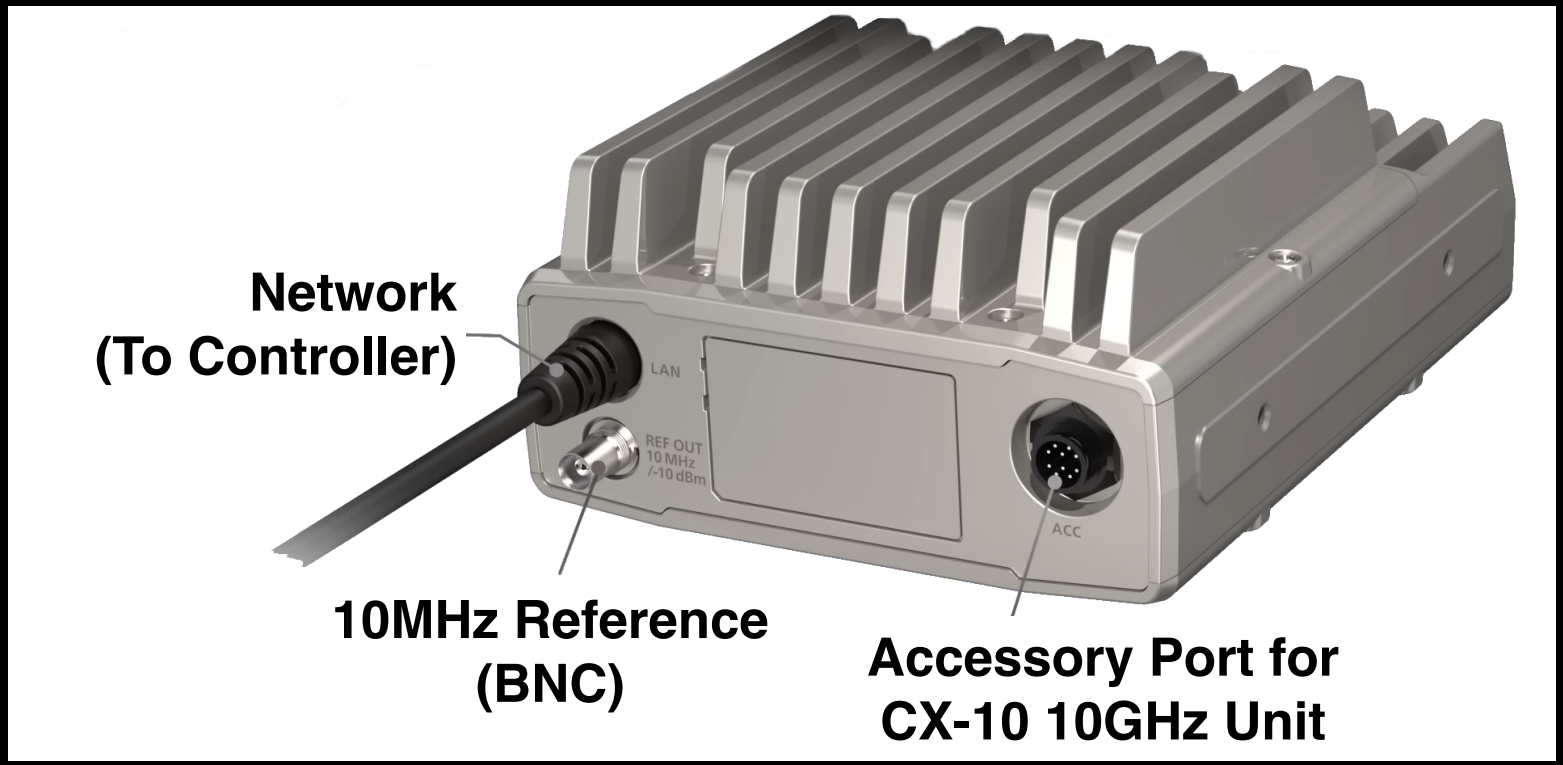
Controller – Right Side



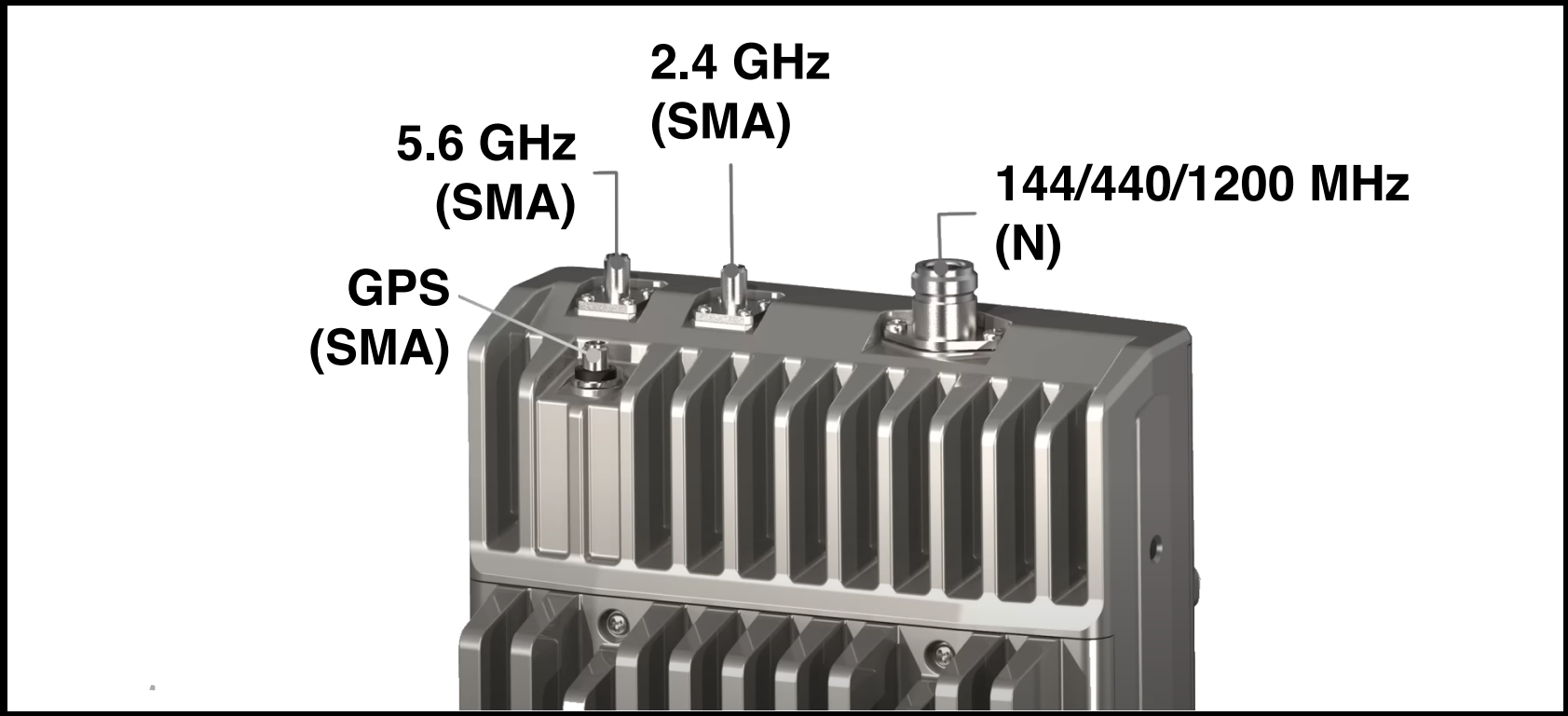
Controller – Left Side



RF Unit - Bottom



RF Unit - Top



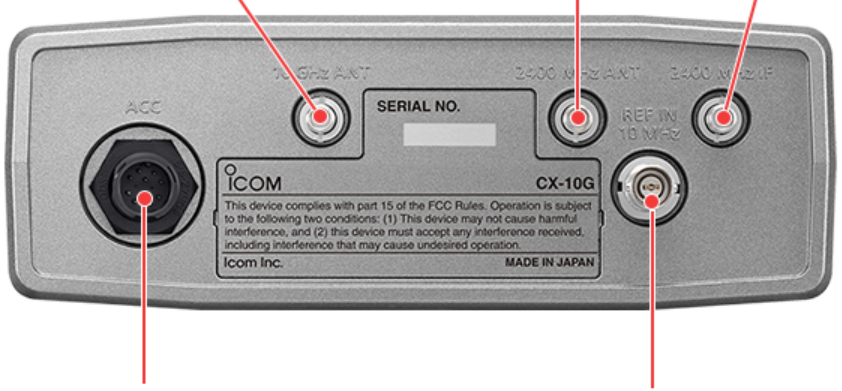
CX-10 10GHz Transverter

CX-10G Bottom Side

10 GHz Antenna Connector (SMA)

2400 MHz Antenna Connector (SMA)

2400 MHz IF Connector (SMA)



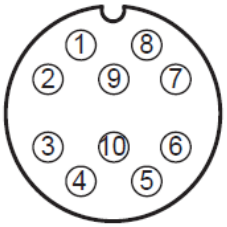
ACC Socket to control from the transceiver

10 MHz REF Input (BNC) from the transceiver

What about Preamps and Amplifiers?

- Mast mounting reduces the need for preamps
- Amplifiers need to be at/on tower and environmentally sealed
- PTT and ALC lines available via accessory connector

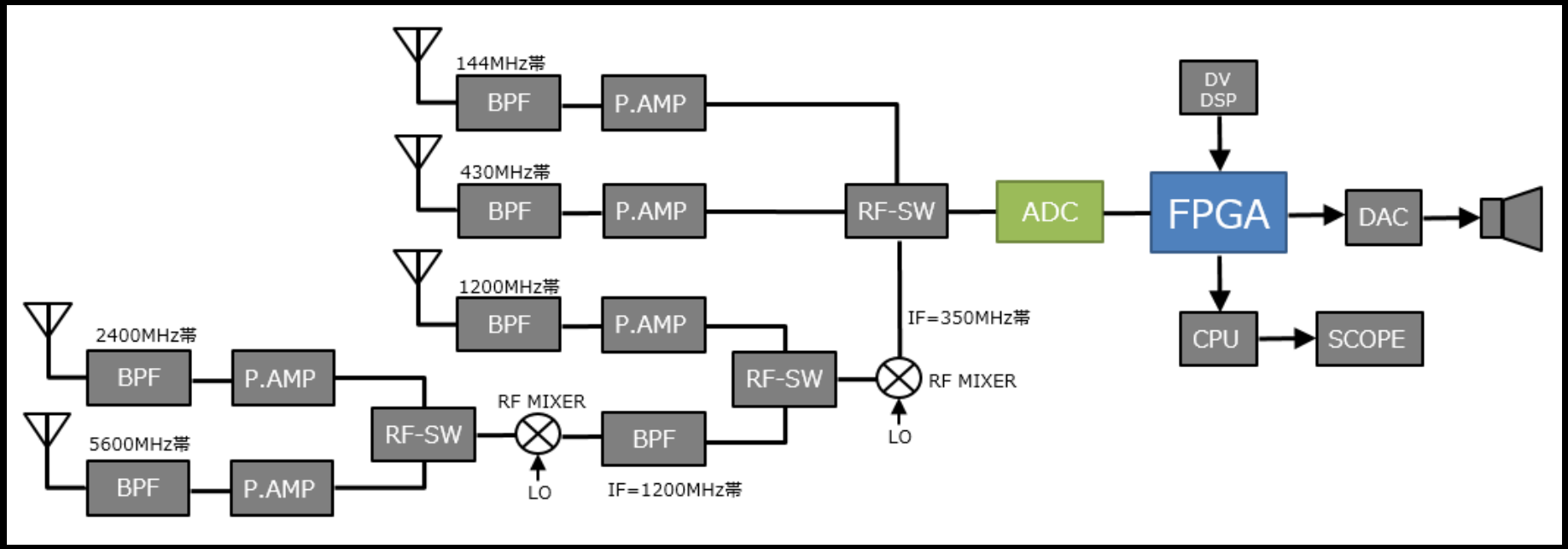
10-pin



Bottom panel view

7	ALC	ALC voltage input.		Input impedance: 10 kΩ or more Input level: –4 ~ 0 V Input voltage: 30 V or less Input current: 0.5 mA or less
8	GND	Connects to ground.		–
9	SEND	Input	When this pin goes to ground, the transceiver transmits.	Voltage: 30 V or less Reverse voltage: 80 V Open circuit voltage: 5 V Voltage (TX): –0.5 ~ +0.8 V Current flow: Maximum 2.27 mA
		Output	This pin goes low when the transceiver transmits.	

Icom IC-905 Architecture



But Who Will I Talk With?

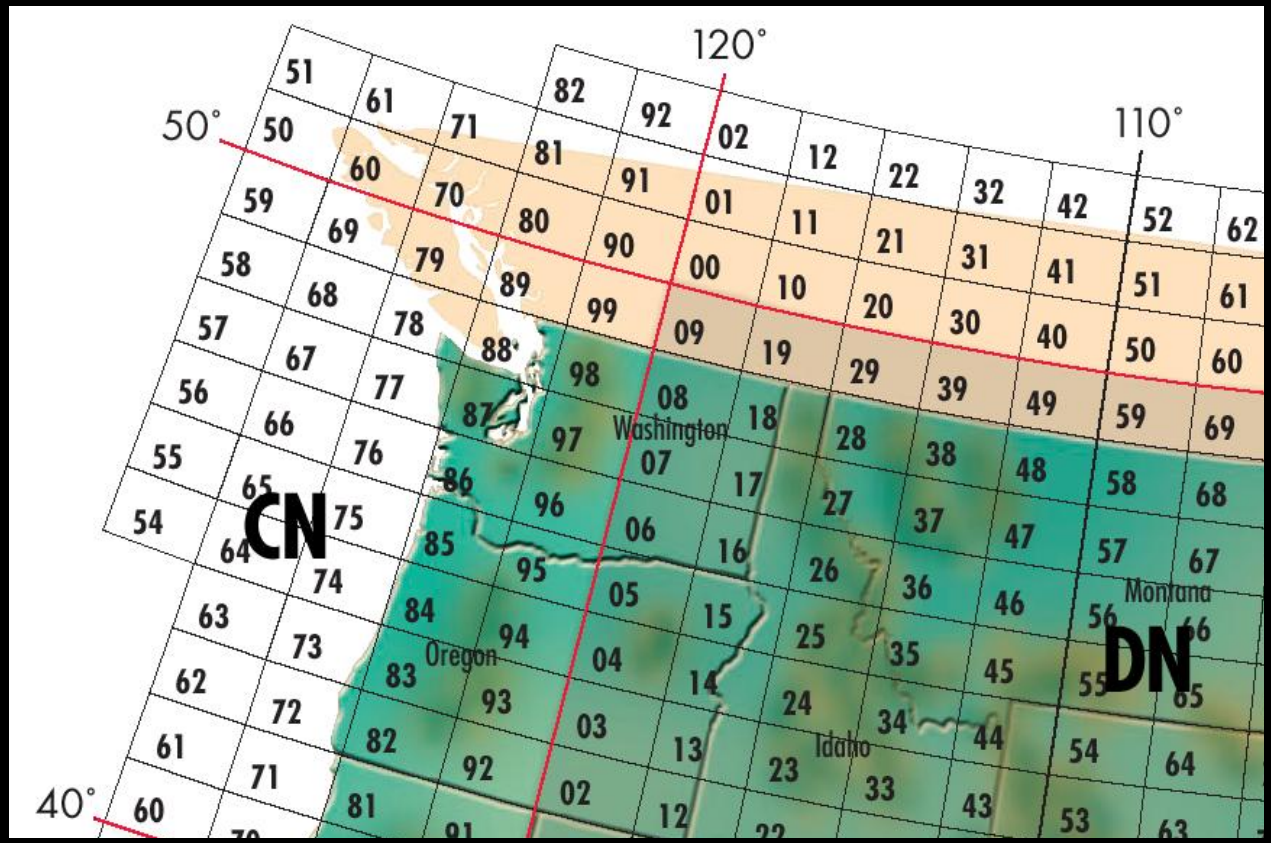
- Weak signal operators
  - Contest weekends can be very busy
  - Digital modes offer interesting opportunities
- Amateur Television (ATV) users
  - Many 5.8GHz “FPV transmitters” available on Amazon
- Satellites
  - Future AMSAT satellites will support “5 and Dime” (5 and 10 GHz)
- Repeaters
  - FM and DSTAR DV/DD Mode

Weak Signal VHF+

- Most activity on contest weekends
  - Look for local VHF+ groups and nets
- Many operator classes available for contesting
  - Single Operator - Low Power, High Power, Portable, 3-Bands, FM-Only
  - Rover stations - Classic, Limited, Unlimited
  - Multioperator - Limited, Unlimited
- Simple contest exchange (Call, Grid Square, e.g. “N7SS CN98”)
- More points per QSO for higher bands
- Scoring is QSO points x Grid points

Maidenhead Grids

- 1 Grid point for each grid contacted per band
- 1 Grid point for each grid activated



VHF/UHF Century Club (VUCC) Award

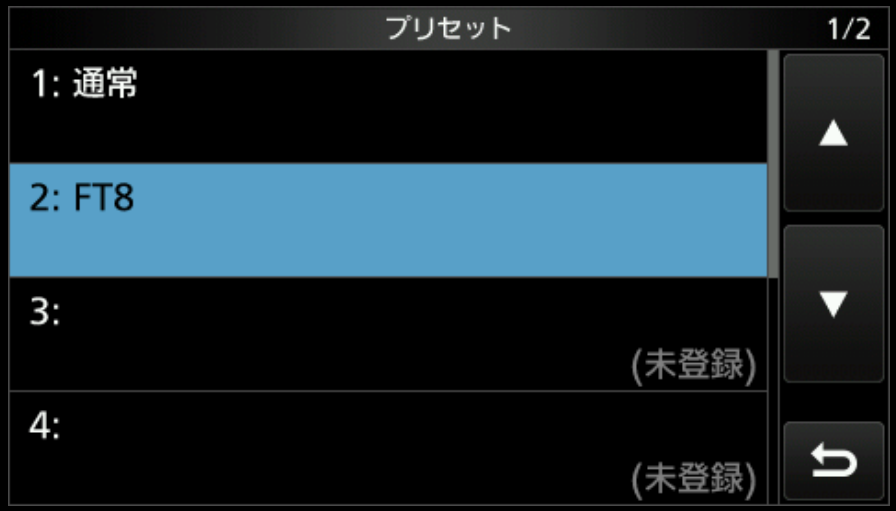
- The minimum number of grid locators needed to initially qualify for each individual band award is as follows:
  - 50 MHz, 144 MHz and Satellite 100 Credits
  - 222 MHz and 432 MHz 50 Credits
  - 902 MHz and 1296 MHz 25 Credits
  - 2.3 GHz 10 Credits
  - 3.4 GHz, 5.7 GHz, 10 GHz 5 Credits
- 50 - 1296 MHz and Satellite, all contacts must be made from locations no more than 200 km apart
- SHF contacts must be from within a 300-meter diameter circle

Digital Modes - WSJT

- FT4, FT8 for very weak signals
- JT6M for ionospheric scatter
- JT65 for EME at VHF/UHF, and for HF skywave propagation
- WSPR - Weak Signal Propagation Reporter
  - Sends and receives low-power transmissions to test propagation paths
  - Users with internet access can watch results in real time at WSPRnet

Digital Modes – FT8 Preset

- Weak signal digital modes are very effective for microwaves
- Troposcatter, aircraft scatter provide enhancements



Amateur Television (ATV)

- Plenty of bandwidth available
- Compatible with many inexpensive 5.8 GHz First Person View (FPV) transmitters available on Amazon

Satellites

- The next generation of AMSAT satellites are called GOLF
  - Greater Orbit, Larger Footprint
- GOLF satellites will include a “five and dime” transponder
  - C band (5.6 GHz) uplink and X band (10 GHz) downlink
- A more typical VHF (144 MHz), UHF (435 MHz) transponder is also planned

References

- Icom IC-905 page https://www.icomamerica.com/lineup/products/IC-905/
- Groups.io https://groups.io/g/ic-905